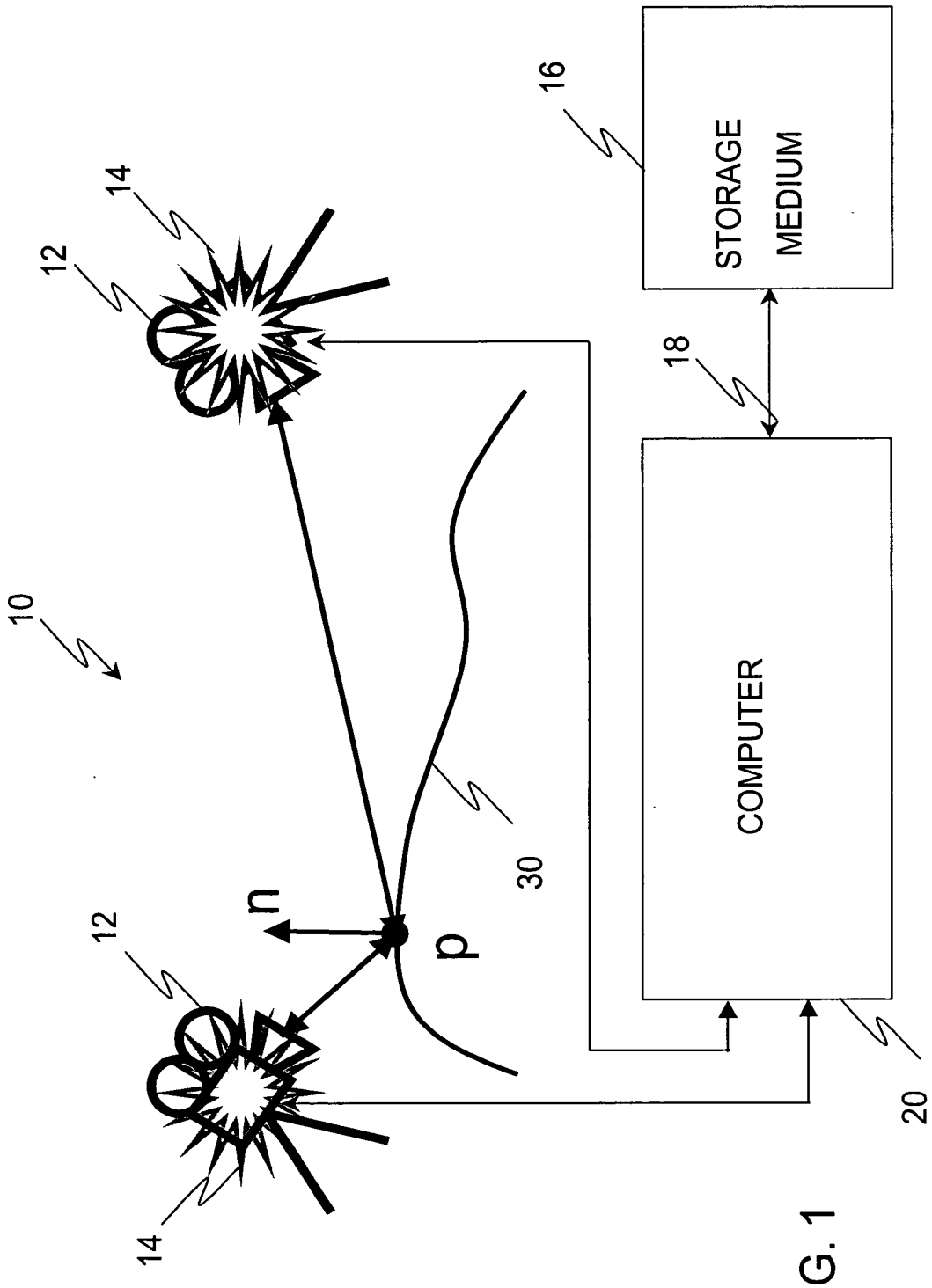


FIG. 1

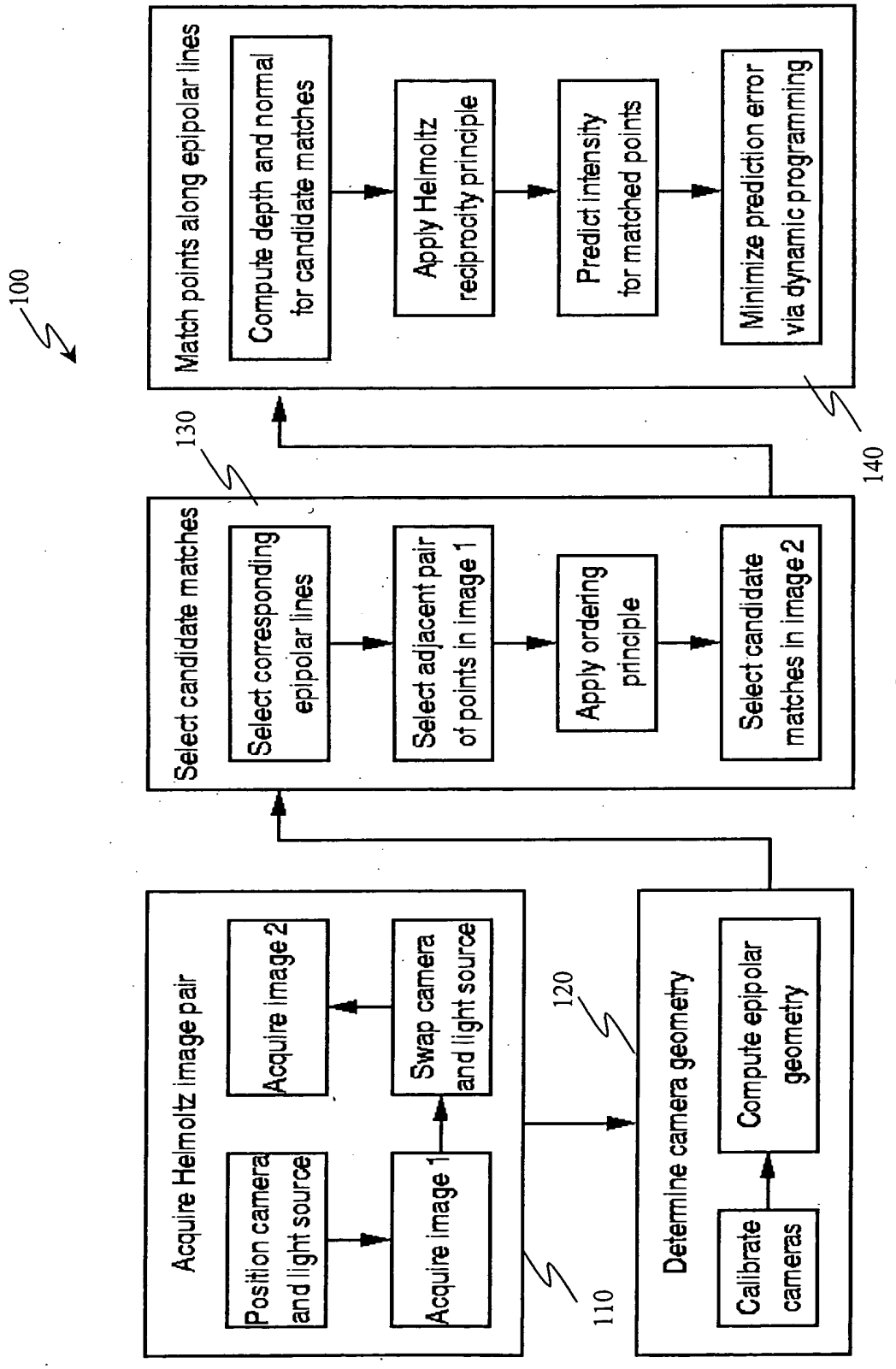

100
Acquire Helmoltz image pair
Position camera and light source
Acquire image 1
Swap camera and light source
Acquire image 2
110
120
Determine camera geometry
Calibrate cameras
Compute epipolar geometry
Select candidate matches
Select corresponding epipolar lines
Select adjacent pair of points in image 1
Apply ordering principle
Select candidate matches in image 2
130
Match points along epipolar lines
Compute depth and normal for candidate matches
Apply Helmoltz reciprocity principle
Predict intensity for matched points
Minimize prediction error via dynamic programming
140

FIG. 2

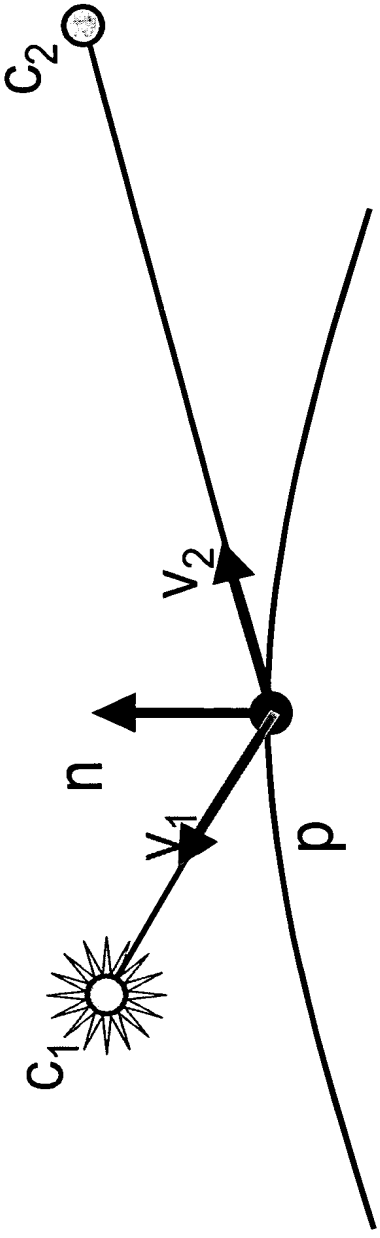


FIG. 3

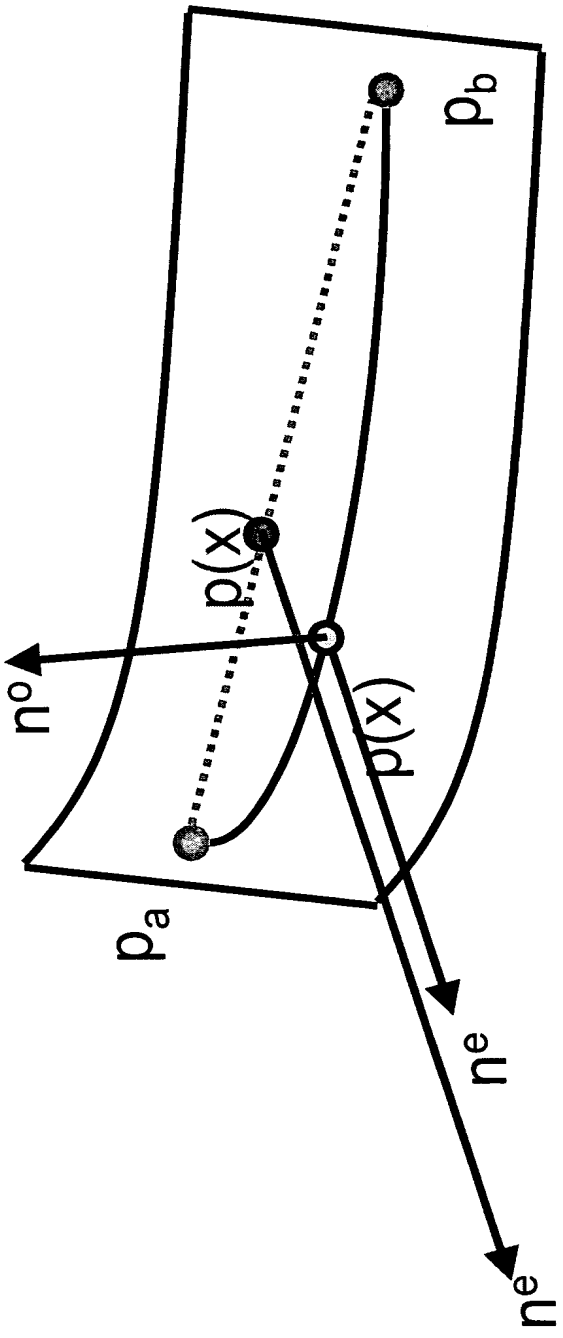


FIG. 4

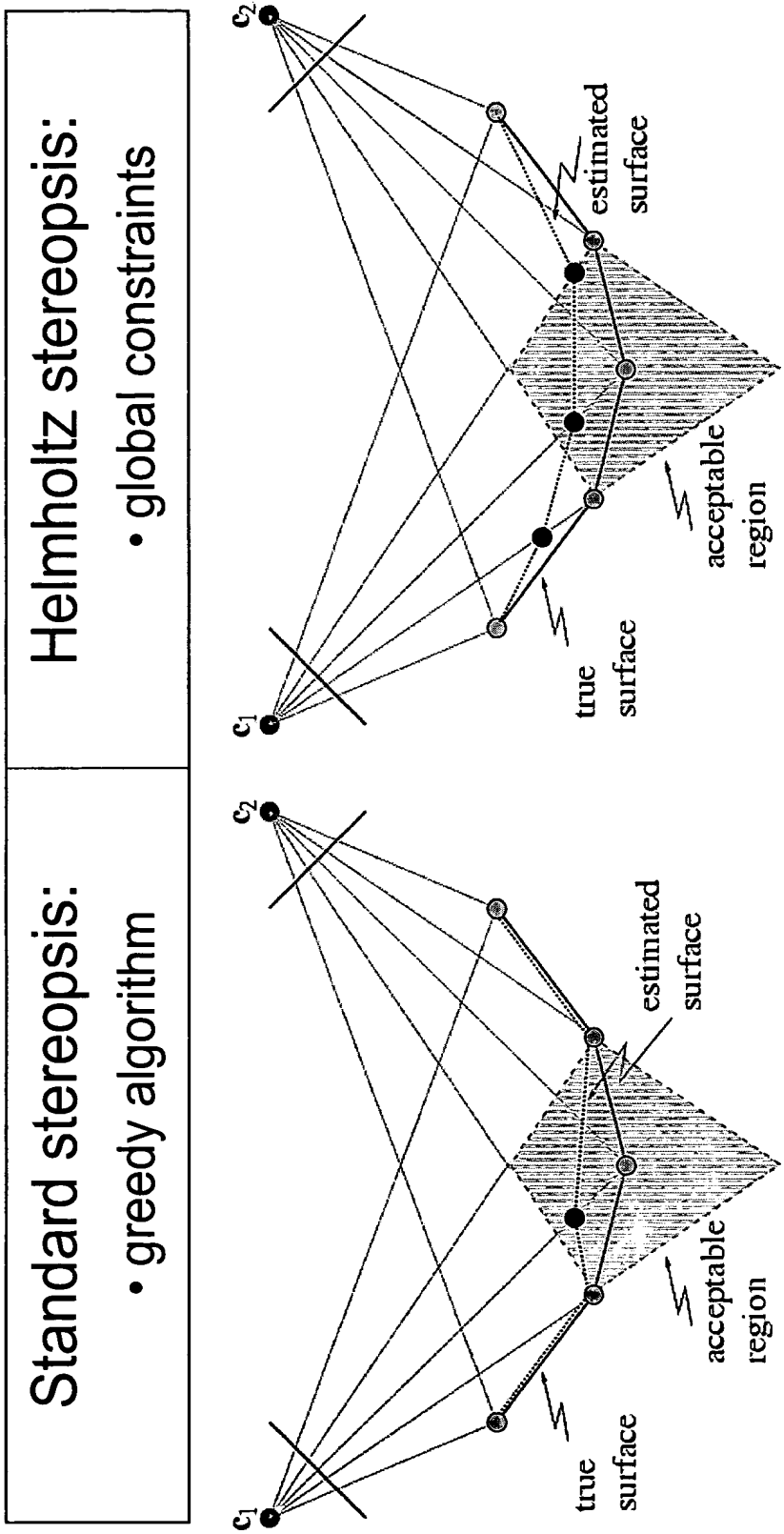

Standard stereopsis:
• greedy algorithm
Helmholtz stereopsis:
• global constraints
c1
c2
true surface
estimated surface
acceptable region
c1
c2
true surface
estimated surface
acceptable region

FIG. 5A

FIG. 5B

- Standard stereopsis: occlusions and shadows are independent.
- Helmholtz stereopsis: occlusions and shadows are mapped to each other.

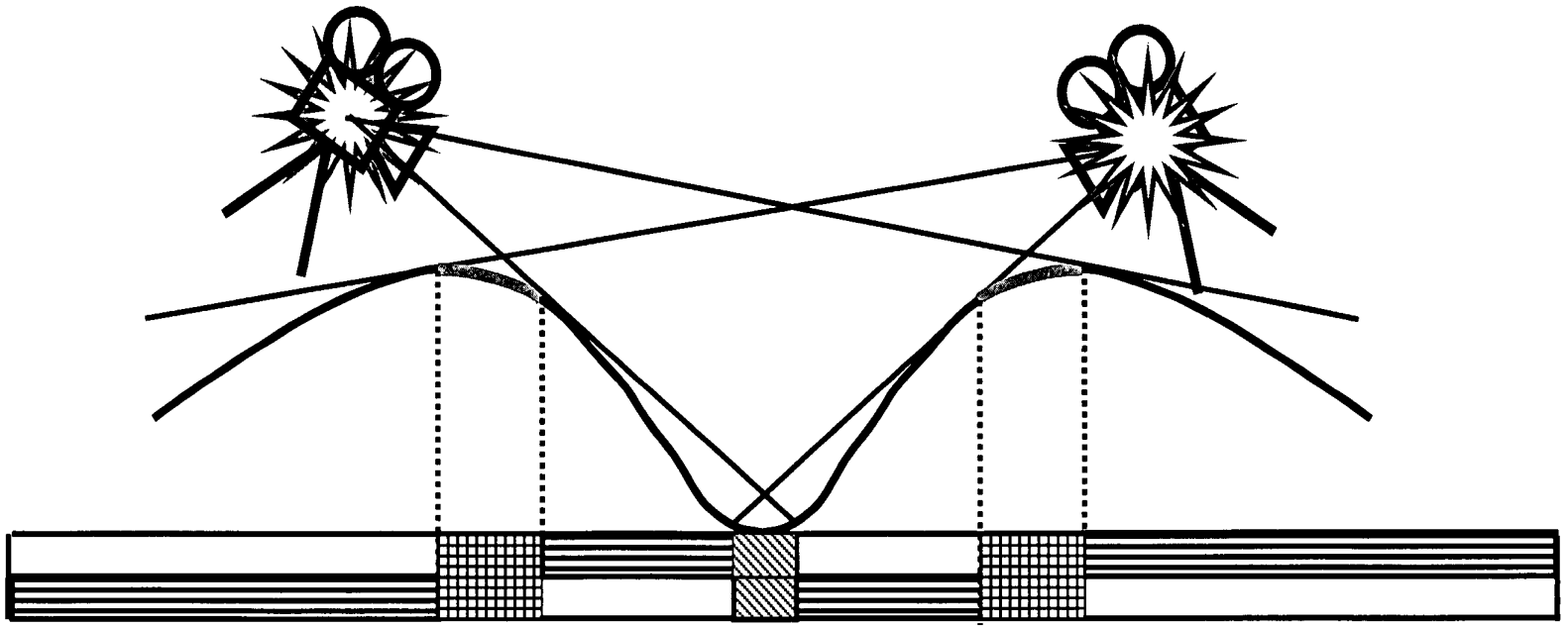
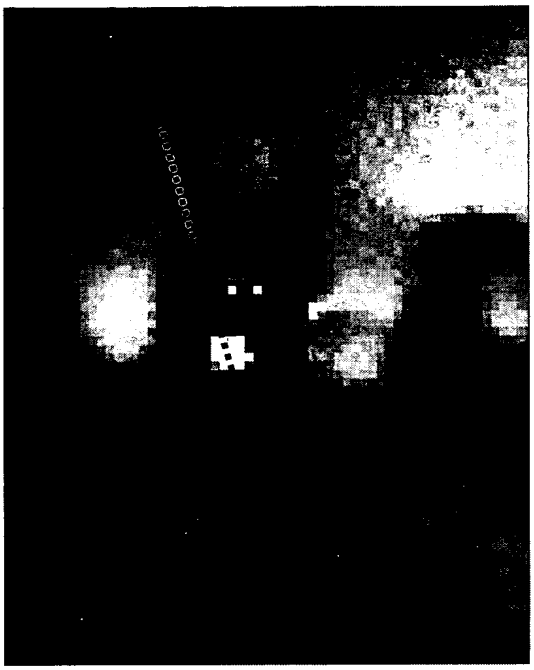


FIG. 6



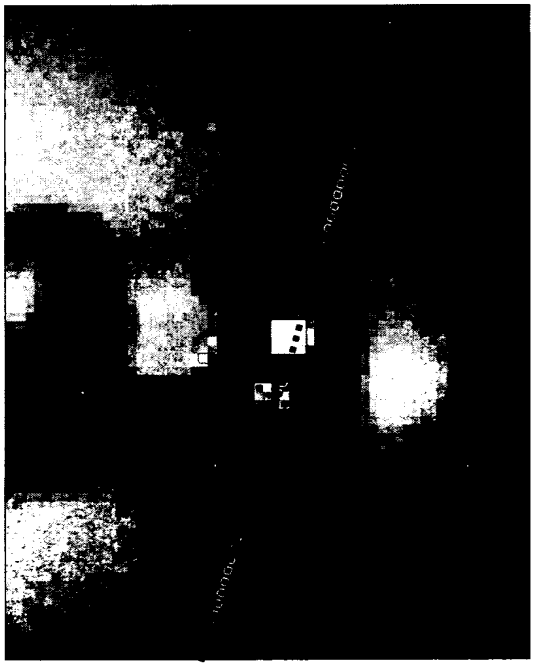


FIG. 7

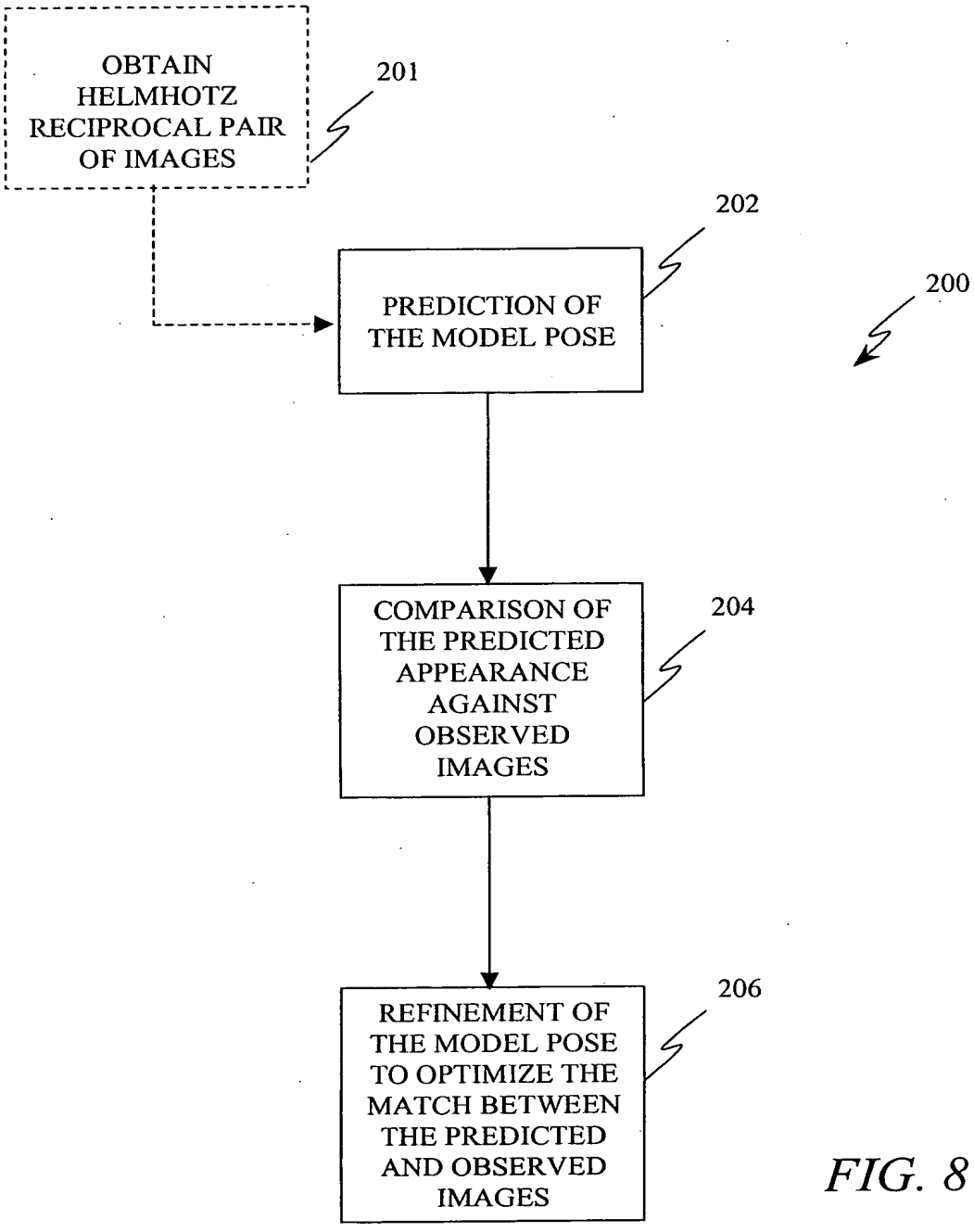

OBTAIN HELMHOTZ RECIPROCAL PAIR OF IMAGES
201
PREDICTION OF THE MODEL POSE
202
200
COMPARISON OF THE PREDICTED APPEARANCE AGAINST OBSERVED IMAGES
204
REFINEMENT OF THE MODEL POSE TO OPTIMIZE THE MATCH BETWEEN THE PREDICTED AND OBSERVED IMAGES
206

FIG. 8

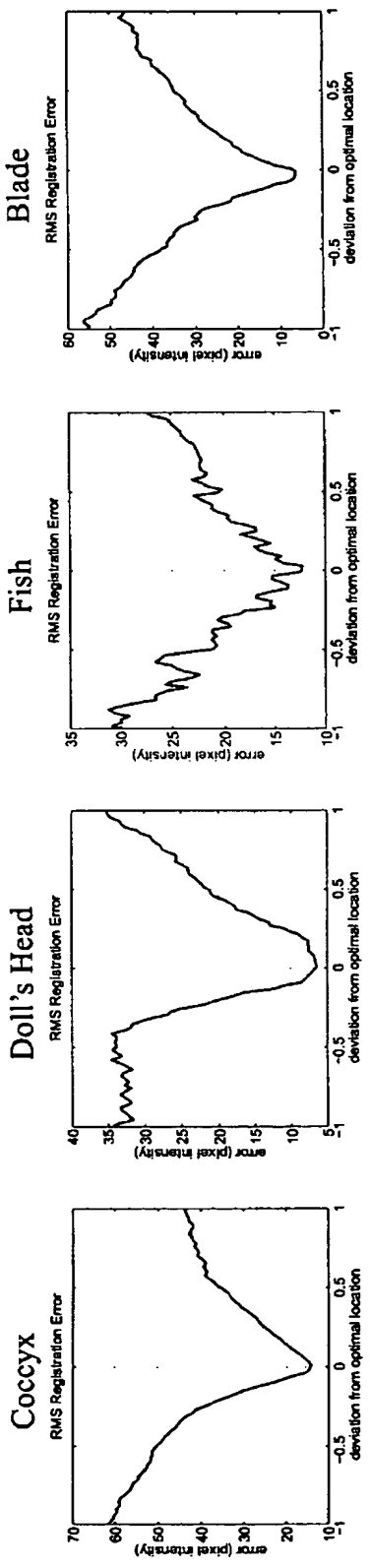

Coccyx
RMS Registration Error
Doll's Head
RMS Registration Error
Fish
RMS Registration Error
Blade
RMS Registration Error
error (pixel intensity)
deviation from optimal location

FIG. 9

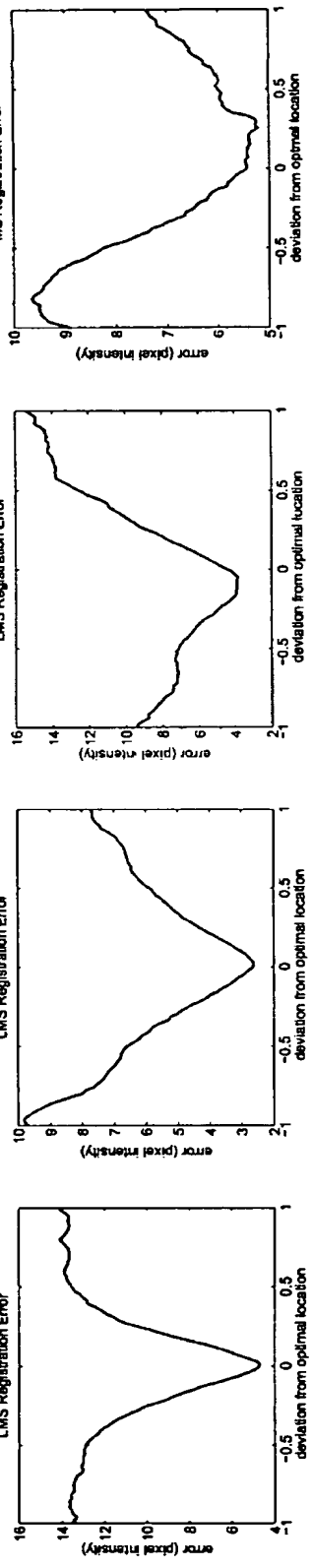

Coccyx
LMS Registration Error
Doll's Head
LMS Registration Error
Fish
LMS Registration Error
Blade
MS Registration Error
error (pixel intensity)
deviation from optimal location

FIG. 10

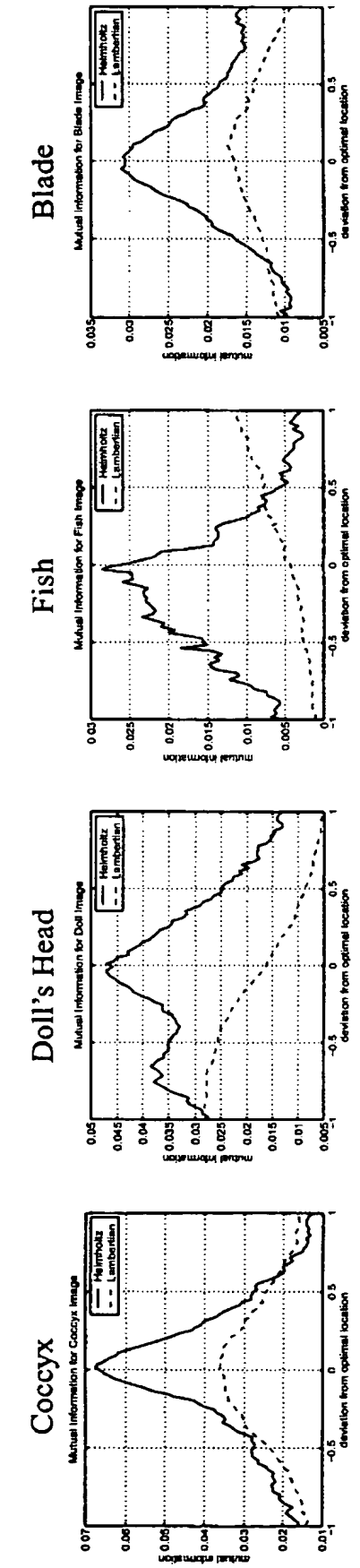

Blade
Fish
Doll's Head
Coccyx
Helmholtz
Lambertian
deviation from optimal location

FIG.11

FIG.12